NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS TERMS AND DEFINITIONS WELL GRADED- INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE, (ALSO HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED WOULD VIELD SET REFLISAL AN INFERRED SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO 1206, ASTM D-1586). SOIL ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD ST REFUSAL.

SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. AQUIFER - A WATER BEARING FORMATION OR STRATA. AP-GRADED INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES. IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZON CLASSIFICATION IS BASED ON THE AGSHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AGSHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <u>ARENACEOUS</u> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ANGULARITY OF GRAINS ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLOWS: ARGILLACEDUS - APPLIED TO ALL ROCKS OR SURSTANCES COMPOSED OF CLAY MINERALS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS; ANGULAR, NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS WEATHERED R HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. SUBANGULAR, SUBROUNDED, OR ROUNDED VERY STIFF, GRAY SILTY CLAY, WOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6 PER FOOT. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL MINERALOGICAL COMPOSITION SOIL LEGEND AND AASHTO CLASSIFICATION AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THA CRYSTALLINE MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. GENERAL GRANIII AR MATERIAI S STI T-CLAY MATERIALS GROUND SUBFACE. ORGANIC MATERIALS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE. CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN NON-CRYSTALLINE A-1 A-3 A-4 A-5 A-6 A-7 GROUP A-1, A-2 0-4 0-5 SEDIMENTARY ROCK THAT WOULD YELLD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.

COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM A-6. A-7 A-1-0 A-1-b CLASS. A-2-4 A-2-5 A-2-6 A-2-7 A-3 SLIGHTLY COMPRESSIBL LIQUID LIMIT LESS THAN 30 OF SLOPE. MODERATELY COMPRESSIBLE LIQUID LIMIT 31-50 <u>CORE RECOVERY (REC.)</u> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SYMBOL HIGHLY COMPRESSIBLE LIGHTO LIMIT GREATER THAN 50 DIMENTARY ROCK SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC PERCENTAGE OF MATERIAL PASSIN DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT SILT-WEATHERING * 10 SILT- CLA ROCKS OR CUTS MASSIVE ROCK. ORGANIC MATERIAL PEAT OTHER MATERIAL SOILS SOILS SOTES ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE. SOILS # 200 15 MX 25 MX 10 MX 35 MX 35 MX 35 MX 35 MX 36 MN 36 MN 36 MN 36 RACE OF ORGANIC MATTER DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE 2 - 3% 3 - 5% 1 - 10% LITTLE ORGANIC MATTER 5 - 12% 10 - 20% 40 MX41 MN 40 MX41 MN 40 MX41 MN 40 MX41 MN VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, SOTI S WITH 5 - 10% 12 - 20% SOME 20 - 35% <u>DIP DIRECTION (DIP AZIMUTH) -</u> THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF PLASTIC INDEX 6 MX N.P. 10 MX 10 MX 11 MN 11 MN 10 MX 10 MX 11 MN 11 MN CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF HIGHLY ORGANIC >20% (V. SLI.) LITTLE OR >10% 35% AND ABOVE THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. HIGHLY OF A CRYSTALLINE NATURE. GROUP INDEX 0 0 4 MX | 8 MX | 12 MX | 16 MX | No M MODERATE GROLIND WATER FAINT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE AMOUNTS OF ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO USUAL TYPES STONE FRAGS.
OF MAJOR
GRAVEL AND
SAND
SAND SOILS SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. STLTY OR CLAYEY CLAYEY ORGANIC WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. (SLI.) 1 INCH. OPEN JOINTS MAY CONTAIN CLAY, IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. GRAVEL AND SAND MATTER SOILS SOILS **Y**___ MATERIALS SAND STATIC WATER LEVEL AFTER 24 HOURS. SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS, IN MODERATE FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM GEN. RATING VPW. GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS (LCOM) PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA PARENT MATERIAL. EXCELLENT TO GOOD POOR AS A FAIR TO POOR UNSUITABL POOR DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED SUBGRADE FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. \bigcirc SPRING OR SEEPAGE P.I. OF A-7-5 ≤ L.L. - 30 : P.I. OF A-7-6 > L.L. ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, IN GRANITOID ROCKS, ALL FELDSPARS DULL CONSISTENCY OR DENSENES MISCELLANEOUS SYMBOLS AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION, ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK, ROCK GIVES "CLUNK" SOUND WHEN STRUCK, SEVERE FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN RANGE OF UNCONFINED (MOD, SEV.) COMPACTNESS OR PRIMARY SOIL TYPE ROADWAY EMBANKMENT OPT DMT TEST BORING IF TESTED, WOULD YIELD SPT REFUSAL PENETRATION RESISTENC COMPRESSIVE STRENGTH CONSISTENCY JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. (TONS/FT2) WITH SOIL DESCRIPTION DESIGNATIONS ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT REDUCE SEVERE _EDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO VERY LOOSE IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME GENERALLY SOIL SYMBOL AUGER BORING (SEV.) S- BULK SAMPLE ITS LATERAL EXTENT. LOOSE EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. GRANULAR MEDIUM DENSE N/A 10 TO 30 ARTIFICIAL FILL OTHER THAN IF TESTED, YIELDS SPT N VALUES > 100 BPF LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. SS- SPLIT SPOON MATERIAL DENSE CORE BORING (NON-COHESTVE) ROADWAY EMBANKMENTS SAMPLE MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN VERY SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT VERY DENSE >50 SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. ST- SHELBY TUBE THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK INFERRED SOIL BOUNDARIES VERY SOFT SAMPLE O, PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN REMAINING, SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR **(0.25** MONITORING WELL GENERALLY SOFT 2 TO 4 VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED, YIELDS SPT N VALUES < 100 BPF 0.25 TO 0.5 NTERVENING IMPERVIOUS STRATUN INFERRED ROCK LINE RS- ROCK SAMPLE MEDIUM STIFF SILT-CLAY PIEZOMETER Ø.5 TO 1 Δ COMPLETE ROCK REDUCED TO SOIL, BOCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. MATERIAL STIFF 8 TO 15 INSTALLATION RT- RECOMPACTED ALLUVIAL SOIL BOUNDARY CCATTERED CONCENTRATIONS, QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS, SAPROLITE IS COHESIVE VERY STIFF ROCK QUALITY DESIGNATION (R.O.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF 2 TO 4 TRIAXIAL SAMPLE SLOPE INDICATOR ALSO AN EXAMPLE. HARD >30 \bigcirc ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND INSTALLATION CBR - CBR SAMPLE ROCK HARDNESS ROCK STRUCTURES EXPRESSED AS A PERCENTAGE. TEXTURE OR GRAIN SIZE \bigcirc SPT N-VALUE SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES J.S. STD. SIEVE SIZE REF- SPT REFUSAL PARENT ROCK. SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK. 4.76 2.0 0.42 0.25 0.075 0.053 SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL COARSE FINE TO DETACH HAND SPECIMEN. BOLL DEB CORRL F GRAVEL SILT TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS CLAY AR - AUGER REFUSAL SAND PMT - PRESSUREMETER TEST (COB.) (GR.) (SL.) MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE (BLDR.) (CL.) SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR BT - BORING TERMINATED SD. - SAND, SANDY EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED 0.005 GRAIN MM 0.05 2.0 0.25 12" CPT - CONE PENETRATION TEST SLI. - SLIGHTLY STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR B.P.F.) OF CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CSE. - COARSE TCR - TRICONE REFUSAL A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH SOIL MOISTURE - CORRELATION OF TERMS DMT - DILATOMETER TEST HARD CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE γ - UNIT WEIGHT 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION POINT OF A GEOLOGISTS PICK. DPT - DYNAMIC PENETRATION TEST SOIL MOISTURE SCALE FIFI D MOISTURE WITH 60 RINWS. √d - DRY UNIT WEIGHT GUIDE FOR FIELD MOISTURE DESCRIPTION CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK, CAN BE EXCAVATED IN FRAGMENTS · - VOID RATIO SOFT STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. F - FINE W - MOISTURE CONTENT FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIR FOSS. - FOSSILIFEROUS V. - VERY PIECES CAN BE BROKEN BY FINGER PRESSURE. SATURATED FRAC. - FRACTURED VST - VANE SHEAR TEST STRATA ROCK QUALITY DESIGNATION (S.R.O.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: (SAT.) FROM BELOW THE GROUND WATER TABLE CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EDUAL TO OR GREATER THAN 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. FRAGS. - FRAGMENTS LIQUID LIMIT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY MED. - MEDIUM FINGERNAIL. SEMISOLID: REQUIRES DRYING TO RANGE - WET - (W) TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. EQUIPMENT USED ON SUBJECT PROJECT ATTAIN OPTIMUM MOISTURE FRACTURE SPACING PLASTIC LIMIT TERM THICKNESS HAMMER TYPE: TERM SPACING BENCH MARK: DRILL UNITS: ADVANCING TOOLS VERY THICKLY BEDDED > 4 FEET VERY WIDE MORE THAN 10 FEET - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE OPTIMUM MOISTURE AUTOMATIC MANUAL THICKLY REDDED 1.5 - 4 FFFT CLAY BITS 3 TO 10 FEET SHRINKAGE LIMIT MOBILE B-ELEVATION: THINLY BEDDED MODERATELY CLOSE 1 TO 3 FEET VERY THINLY BEDDED 0.03 - 0.16 FEET 6 CONTINUOUS FLIGHT AUGER REQUIRES ADDITIONAL WATER TO CORE SIZE: CLOSE 016 TO 1 FEET NOTES: THICKLY LAMINATED 0.008 - 0.03 FEET - DRY - (D) BK-51 VERY CLOSE LESS THAN 0.16 FEET ATTAIN OPTIMUM MOISTURE 8 HOLLOW AUGERS THINLY LAMINATED < 0.008 FEET П-в__ PLASTICITY INDURATION HARD FACED FINGER BITS CME-45 B FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. PLASTICITY INDEX (PI) DRY STRENGTH TUNG.-CARBIDE INSERTS П-н___ VPLASTIC VERY LOW 0-5 CME-550 RUBBING WITH FINGER FREES NUMEROUS GRAINS FRIABLE CASING W/ ADVANCER W PLASTICITY 6-15 GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. HAND TOOLS: MED, PLASTICITY 16-25 MEDIUM PORTABLE HOIST TRICONE STEEL TEETH POST HOLE DIGGER GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE: HIGH PLASTICIT 26 OR MORE MODERATELY INDURATED BREAKS EASILY WHEN HIT WITH HAMMER. TRICONE HAND AUGER * TUNG.-CARB. OTHER GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE: INDURATED SOUNDING ROD CORE BIT DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN. RED. YEL-BRN, RLUE-GRAY) DIFFICULT TO BREAK WITH HAMMER. OTHER VANE SHEAR TEST MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE. OTHER SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; EXTREMELY INDURATED OTHER SAMPLE BREAKS ACROSS GRAINS.

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